

REMARKS

The enclosed is responsive to the Examiner's Office Action mailed on January 26, 2009. By way of the present response Applicants have amended claim 1, added no claims, cancelled no claims, and withdrawn claims 5 and 17-42. Applicants respectfully request reconsideration of the present application.

Claim 1 has been amended to change "and/or" to "or."

Applicants reserve all rights with respect to the applicability of the Doctrine of Equivalents.

Restriction Requirement

The Office Action alleges that the present application contains inventions or groups of inventions which are not linked by a single general inventive concept under PCT Rules 13.1 and 13.2 as shown by U.S. Patent No. 5,521,819 to Greenwood (hereinafter "Greenwood") and European Patent No. 0 925 992 to Nissan (hereinafter "Nissan") as set forth in the Written Opinion of the International Searching Authority ("PCT/ISA/220"). Applicants thank the Examiner for clarifying in a telephone conversation with applicants' representative held February 24, 2008 that the restriction requirement is based upon the aforementioned references and that the reference cited by the Office Action dated January 26, 2009 was the result of a typographical error. After further inspection of the PCT/ISA/220, applicants would like to point out that there was no unity of invention rejection, only an opinion regarding novelty and inventiveness. Nevertheless, applicants will address the rejection as follows.

Applicants provisionally elect to prosecute Group IA (claims 1-16 and 43) and species A2 (claim 6), with traverse. Therefore, claims 1-4, 6-16, and 43 have not been withdrawn.

Applicants respectfully submit that all of the claims are drawn to a similar subject matter – i.e., not independent or distinct -- and that the search and examination of all the claims in the application can be made without serious burden on the Examiner.

With respect to paragraph 5 of the Office Action, it is respectfully submitted that Greenwood does not teach or suggest a combination with Nissan and that Nissan does not teach or suggest a combination with Greenwood. Greenwood describes a method of controlling a continuously variable ratio transmission including a variator. Nissan, however, is concerned with the control of a different type of transmission that teaches away from Greenwood and the subject matter of the present application.

Nissan describes a ratio-controlled transmission. Nissan states that the “axes of rotation of the rollers are offset by the servo valve system and the stepping motor, which are disclosed in US-A5083473, in response to the ratio actuator command signal.” (Nissan, paragraph [0065]). The system in Nissan includes servo control of the roller inclination (corresponding to variator drive ratio). An electronic input determines where the rollers are to be positioned. The servo valve and stepping motor together sense the actual roller position and adjust it toward the required position. Hence the electronics associated with the transmission can directly set the transmission ratio. (see Nissan, paragraphs [0060]-[0065]). One may assume that the control of a vehicle transmission (manual, stepped automatic,

or CVT) will involve selecting and directly setting the drive ratio. However, that assumption is not appropriate to the type of transmission described in the present application.

Claim 1 recites “the variator receiving a primary control signal and being constructed and arranged such as to exert upon its input and output members torques which, for a given variator drive ratio, correspond directly to the control signal.” In such a transmission, the control signal does not directly determine transmission ratio. Instead, it determines the torques created by the variator at its input and output. The variator permits its own ratio to change as the torques it creates, added to externally imposed torques from the engine and wheels, cause the engine and vehicle to accelerate/decelerate. For example, if the vehicle driver applies the brakes to slow the vehicle, the drive ratio provided by the transmission as a whole, and specifically by the variator, will have to change. This could however be achieved without any change to the primary control signal – as the vehicle slows, the variator automatically accommodates the resultant change in drive ratio. It goes on creating the reaction torque determined by the primary control signal while the positions of the variator rollers and the resultant ratio vary as necessary.

There are challenges associated with the control of this type of transmission (hereinafter “torque-controlled transmission”) which do not arise in connection with more conventional transmissions in which direct control is exercised over ratio. For example, when using a ratio-controlled transmission, there is a direct correspondence between vehicle speed and engine speed, as determined by the chosen transmission ratio. Control of the engine speed is thus relatively straightforward. However, engine speed control is wholly different in a torque-

controlled transmission. There is no direct way to establish a relationship between engine speed and vehicle speed. Instead, as explained in the present application, engine speed control depends on management of the dynamic balance between torque created by the engine and torque created at the variator input applied to the engine by the variator. A net imbalance between the two will cause acceleration and failure to manage such an imbalance would result in an uncontrolled variance in engine speed.

Nissan describes choosing a target transmission ratio based upon a target engine speed and using a mathematical delay function to adjust the transmission along a controlled path. (see Nissan paragraphs [0069]-[0092]). The “inertia torque” can be calculated and the engine setting can be modified so that the application of this inertia torque does not create unwanted deviations in the torque experienced by the driver. Such a process is not carried out with a torque-controlled transmission and is dissimilar from the present application. The control system of the present application does not, in the direct way contemplated by Nissan, impose a profile upon changes in transmission ratio. Instead, as described above, the present application depends upon the management of the dynamic balance of engine torque and loading torque at the engine-transmission interface.

Additionally, applicants respectfully submit that the combination of Greenwood and Nissan fails to disclose:

determining a target engine acceleration,
determining settings of the variator's primary
control signal and of an engine torque control for
providing the required engine acceleration and adjusting
the control signal or the engine torque control based on
these settings,
predicting a consequent engine speed change,
and

correcting the settings of the control signal and engine torque based on a comparison of actual and predicted engine speeds.

(Claim 1).

The combination is focused on adjustments based upon a chosen engine speed target, not a prediction of engine speed change.

Similarly, the combination fails to disclose

determining a target engine acceleration,
determining an excess torque $TrqAcc$ required to accelerate power train inertia to achieve the target engine acceleration, and
adjusting the control signal to the variator and/or adjusting a torque controller of the engine such that engine torque is equal to loading torque applied by the transmission to the engine plus the excess torque $TrqAcc$, such that the excess torque acts upon the relevant power train inertia and causes engine acceleration.

(Claim 17).

Lastly, the combination fails to disclose

A method of controlling engine speed error in a motor vehicle powertrain comprising an engine which drives at least one vehicle wheel through a transmission which provides a continuously variable ratio, the transmission being constructed and arranged to exert upon the engine a controlled loading torque and to **permit the transmission ratio to vary in accordance with resultant changes in engine speed**, so that engine acceleration results from application of a net torque, which is the sum of the loading torque and an engine torque created by the engine, to the inertias referred to the engine, the method comprising, in a feedback loop:

determining the engine speed error,
supplying the engine speed error to a closed loop controller which establishes a control effort, which is a correction to the net torque required to reduce the engine speed error,
establishing, taking account of the control effort, an allocation of the control effort between (i) adjustment

of the engine torque and (ii) adjustment of the loading torque, and effecting the adjustment(s).

(Claim 29) (emphasis added).

As discussed above, Nissan describes a ratio-controlled transmission, not a torque-controlled transmission, and thus cannot permit the transmission ratio to vary in accordance with resultant changes in engine speed. In contrast to claim 29, Nissan (and thus the combination) describes a speed control loop which outputs a stepping motor position command – i.e., errors in engine speed are corrected directly by changing the ratio. (Nissan Fig. 4 and paragraph [0055]). As discussed above, a torque-controlled transmission does not operate in this manner.

CONCLUSION

Applicants respectfully submit that the Restriction Requirement has been traversed. Nevertheless, applicants reserve the right to file one or more divisional applications drawn to the subject matter of the nonelected claims.

Pursuant to 37 C.F.R. 1.136(a)(3), applicants hereby request and authorize the U.S. Patent and Trademark Office to (1) treat any concurrent or future reply that requires a petition for extension of time as incorporating a petition for extension of time for the appropriate length of time and (2) charge all required fees, including extension of time fees and fees under 37 C.F.R. 1.16 and 1.17, to Deposit Account No. 02-2666.

Respectfully submitted,

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